

PURCHASE DESCRIPTION
RADIO TEST SET/COMMUNICATIONS ANALYZER

SCAT 4345

- 1.0 **GENERAL** This procurement requires a portable radio test set for use with radio receiving and transmitting equipment.
- 2.0 **CLASSIFICATION** The equipment shall conform to the requirements of MIL-PRF-28800F Class 2 for shipboard applications, with the following exceptions:
 - (a) Non-operating temperature: -40° to 71°C,
 - (b) Altitude requirement not invoked.
- 3.0 **OPERATIONAL REQUIREMENTS** The equipment shall be capable of signal generation, monitoring, amplitude level and frequency measurement, power measurement, modulation analysis, and receiver signal-to-noise measurement within the parameters and accuracies specified herein.
 - 3.1 **RF Signal Generator**
 - 3.1.1 Generator frequency range: 400 kHz to 999.99 MHz tunable in 100 Hz increments
 - 3.1.2 Generator frequency accuracy: Equal to the time base accuracy (see paragraph 3.11) + 0.5 Hz
 - 3.1.3 Residual FM: 25 Hz rms; 0.3 to 3 kHz post detection bandwidth
 - 3.1.4 Generator output power: At least -110 dBm to -40 dBm in 0.1 dB or smaller increments
 - 3.1.4.1 Accuracy: ± 2.0 dB
 - 3.1.5 Generator spectral purity:
 - 3.1.5.1 Harmonics: -25 dBc
 - 3.1.5.2 Non-harmonics: -50 dBc
 - 3.1.5.3 SSB phase noise: -108 dBc/Hz at 20 kHz offset
 - 3.1.6 Modulation: FM and AM from internal source, external source, and supplied microphone
 - 3.1.6.1 Frequency Modulation:
 - 3.1.6.1.1 Deviation: 0 to 25 kHz peak from 1 MHz to 999.99 MHz
 - 3.1.6.1.1.1 Accuracy: $\pm 8\%$ at 1 kHz rate and 10 kHz deviation
 - 3.1.6.2 Amplitude modulation:
 - 3.1.6.2.1 Frequency Response: 20 Hz to 10 kHz
 - 3.1.6.2.2 Depth: 0 to 90% from 1.5 MHz to 999.99 MHz RF
 - 3.1.6.2.3 Accuracy: $\pm 5\% \pm 1$ least significant digit (LSD) at 1 kHz rate and 50% depth {RF frequencies ≤ 400 MHz}
 $\pm 7\% \pm 1$ LSD at 1 kHz rate and 50% depth {RF frequencies > 400 MHz}
 - 3.1.7 RF Connector: Type-N female

3.2 RF Signal Analyzer

- 3.2.1 Analyzer frequency range: 400 kHz to 999.99 MHz
- 3.2.2 RF analyzer input sensitivity: 5 mW or less
- 3.2.3 Single sideband demodulator: A single sideband demodulator or other means shall be provided for detecting single sideband transmissions.
- 3.2.4 RF frequency error measurement: The analyzer shall indicate the difference in frequency of the RF signal under test and a predetermined value entered by the operator.
 - 3.2.4.1 RF frequency error measurement accuracy: ± 1 Hz + the time base accuracy
 - 3.2.4.2 RF frequency error measurement resolution: 1 Hz or less
 - 3.2.4.3 RF frequency error measurement range: ± 10 kHz minimum
- 3.2.5 FM deviation measurement: At RF frequencies from 5 MHz to 999.99 MHz and modulation frequencies of 150 Hz to 10 kHz
 - 3.2.5.1 FM deviation measurement range: 1 kHz to 25 kHz peak deviation
 - 3.2.5.2 FM deviation measurement accuracy: $\pm 7.5\%$ of indication plus peak residual FM
 - 3.2.5.3 FM input sensitivity: 5.0 μ V at 10 dB EIA SINAD
- 3.2.6 AM depth measurement: At RF frequencies from 10 MHz to 999.99 MHz and modulation frequencies of 300 Hz to 10 kHz
 - 3.2.6.1 AM depth measurement range: 0 to 90%
 - 3.2.6.2 AM depth measurement accuracy: $\pm 8\%$ FS + 1 LSD
- 3.2.7 Signal strength measurement: A means shall be provided to measure the relative level of off-the-air signals received by an antenna supplied with the instruments.
 - 3.2.7.1 Measurement frequency range: 3 MHz to 999.99 MHz
 - 3.2.7.2 Measurement level range: -100 dBm to +10 dBm
- 3.3 RF Wattmeter An RF wattmeter and load shall be provided to measure the power generated by units under test at frequencies above 1.5 MHz, and to terminate a 50 ohm system with an SWR of 1.25:1 or less up to 500 MHz and 1.35:1 or less from 500 MHz to 999.99 MHz.
 - 3.3.1 RF wattmeter power measurement
 - 3.3.1.1 RF wattmeter power measurement range: 1 mW to 60W
 - 3.3.1.2 RF wattmeter power measurement accuracy: $\pm 10\%$ of indication for inputs > 200 mW
 - 3.3.2 Wattmeter over-temperature protection: Visual and audible over-temperature warnings shall be provided.
- 3.4 Duplex Generator A duplex generator function or other means shall be provided to test equipment transmitting and receiving simultaneously on offset frequencies.
 - 3.4.1 Duplex frequency offset: Full offset capability shall be provided.
 - 3.4.2 Duplex output:
 - 3.4.2.1 Output level: At least -110 dBm to 0 dBm
 - 3.4.2.2 Resolution: 0.1 dBm
 - 3.4.3 Duplex generator deviation: The carrier shall be capable of being frequency modulated at deviations from 0 to 25 kHz peak.
 - 3.4.4 Sensitivity: In duplex mode, the equipment shall operate properly with input levels of 20 mW or less.
 - 3.4.5 Connector: BNC female or compatible via adapter.

- 3.5 Spectrum Analyzer The equipment shall be provided with a spectrum analyzer in accordance with the following specifications:
 - 3.5.1 Frequency range: 400 kHz to 1 GHz
 - 3.5.2 Scan widths: At least 50 kHz to 1 MHz/div
 - 3.5.3 Resolution bandwidths: 300 Hz to 300 kHz
 - 3.5.4 Sensitivity: -95 dBm at lowest resolution bandwidth
 - 3.5.5 Dynamic range: 80 dB displayed range
 - 3.5.6 Display log scales: At least 10 dB/div
 - 3.5.7 Average noise level: Less than -90 dBm at the lowest resolution bandwidth
 - 3.5.8 Level accuracy: ± 3 dB
 - 3.5.9 Markers: Independently tunable markers shall provide readouts of frequency and amplitude for any point and relative readings between center frequency and any other point.
 - 3.5.10 Tracking generator: A tracking generator shall be provided that has frequency and output power equivalent to that of the signal generator (see 3.1.1 and 3.1.4).
- 3.6 Oscilloscope An oscilloscope function shall be provided to monitor the modulation characteristics of AM and FM signals.
 - 3.6.1 Display size: At least 9 in ² (58 cm ²)
 - 3.6.2 Frequency response: At least 2 Hz to 20 kHz.
 - 3.6.3 Vertical input ranges: 10 mV to 10 V/div
 - 3.6.4 Oscilloscope horizontal sweep rate: 100 μ s/div to 20 ms/div
- 3.7 AF Voltmeter An AF voltmeter shall be provided for DC and AC voltage measurements.
 - 3.7.1 AC measurements:
 - 3.7.1.1 Frequency range: 50 Hz to 20 kHz
 - 3.7.1.2 Level range: 0 to 30 Vrms
 - 3.7.1.3 Accuracy: $\pm(3\%$ of indication + 3 mV + 1 LSD)
 - 3.7.2 DC measurements:
 - 3.7.2.1 Level range: 0 to 40 V
 - 3.7.2.2 Accuracy: $\pm(1\%$ of indication + 50 mV)
- 3.8 AF Frequency Measurement A frequency counter function shall be provided to measure audio frequencies.
 - 3.8.1 Measurement range: 20 Hz to 20 kHz
 - 3.8.2 Measurement resolution: 1 Hz
 - 3.8.3 Measurement accuracy: ± 2 counts
- 3.9 SINAD Meter A means shall be provided to measure the sensitivity of a receiver with respect to the ratio of the signal plus noise and distortion to noise and distortion.
 - 3.9.1 Input Frequency: the equipment shall provide a test signal modulated by 1 kHz to the receiver under test.
 - 3.9.2 Input Level Range: 0.1 Vrms to 10 Vrms

- 3.9.3 Measurement range: 3 dB to 30 dB
- 3.9.4 Measurement accuracy: ± 1.0 dB at 12 dB EIA SINAD
- 3.10 Distortion Measurements
 - 3.10.1 Fundamental frequency: 1 kHz nominal
 - 3.10.2 Level range: 100 mVrms to 10 Vrms
 - 3.10.3 Distortion range: 1% to 20 %
 - 3.10.4 Distortion accuracy: ± 2 dB
- 3.11 Signal to Noise (S/N) Measurements
 - 3.11.1 Level range: 50 mVrms to 10 Vrms
 - 3.11.2 S/N range: 0 to 100 dB
 - 3.11.3 S/N accuracy: ± 1 dB
 - 3.11.4 Resolution: 0.1 dB
- 3.12 Audio Filters: 50 Hz high-pass, 300 Hz high-pass, 15 kHz low-pass, 3 kHz low-pass and 1 kHz notch.
- 3.13 AF Signal Generator Two independent variable audio frequency signal generators shall be provided to generate the tones required by various two-tone signaling systems such as dual tone, multiple frequency (DTMF).
 - 3.13.1 Frequency range: 10 Hz to 20 kHz
 - 3.13.2 Frequency resolution: 1 Hz
 - 3.13.3 Output level: 4 Vrms into 600 ohms, balanced or unbalanced
- 3.14 Time Base
 - 3.14.1 Accuracy: ± 0.1 ppm
 - 3.14.2 Aging: 0.5 ppm per year
 - 3.14.3 Temperature stability: ± 0.05 ppm from 0 to 55°C
- 3.15 Reference Frequency Input: An external frequency standard input shall be provided which will accept 1, 2, 5, and 10 MHz inputs.
- 3.16 Loud Speaker The equipment shall contain an internal speaker.
- 3.17 Signaling The unit shall provide a selective call encoder/decoder with the capability to generate and analyze common signaling formats used in mobile radio, cellular phones and trunked radio systems. Signaling formats supported shall include, but not be limited to, DTMF, 1 Tone, 2 Tone, Tone Sequential, Advanced Mobile Phone System (AMPS) and Total Access Communication System (TACS). The equipment shall support the testing of the repeaters and radios used for EDACS trunked radio systems
- 3.18 Programming The unit shall provide a means of performing preprogrammed test routines under control of a built-in computer with at least 40k bytes of on-board RAM. The unit shall include the capability of loading automated test routines from either memory cards or from floppy disks. Software to automatically perform radio tests such as intermodulation products tests shall be provided.

- 3.19 Accessories For audio analysis, the equipment shall be provided with a 600 ohm input impedance or a 600 ohm balanced interface as an accessory.

4.0 **GENERAL REQUIREMENTS**

- 4.1 Power Source: MIL-PRF-28800F nominal AC and external DC power source requirements are invoked.
- 4.1.1 Maximum AC power consumption: 250W
- 4.1.2 External DC Power: 11-28 VDC at 120 W maximum power consumption. The equipment shall be provided with a DC power cord for connecting to external DC sources.
- 4.2 Lithium Batteries: Per MIL-PRF-28800F, lithium batteries are prohibited without prior authorization. Requests for approving the use of lithium batteries, including those encapsulated in integrated circuits, shall be submitted to the procuring activity at the time of submission of proposals. Approval shall apply only to the specific model proposed.
- 4.3 Weight: 21 kg (46 lb) maximum.
- 4.4 Vibration, Sinusoidal: The sinusoidal vibration requirements of MIL-PRF-28800F, Class 2 equipment are invoked in addition to the random vibration requirements. The equipment shall conform to specified performance and accuracy requirements after the sinusoidal vibration conditions specified in MIL-PRF-28800F, Table 4 when tested in accordance with MIL-PRF-28800F paragraph 4.5.5.3.2.
- 4.5 Digital Interface: A digital interface shall be provided in accordance with MIL-PRF-28800F. The interface shall comply with IEEE 488.2 Standard Codes and Formats and specifically with the following IEEE 488.2 subsets.
- a. SH1
 - b. AH1
 - c. T6
 - d. L4
 - e. SR1
 - f. RL1
 - g. E1
 - h. DC1
 - i. DT0
- 4.6 Calibration Interval: The calibration interval shall be 12 months minimum. At the end of this interval, the equipment shall be within all accuracy requirements specified herein with a 85% or greater confidence factor. Manufacturer shall submit data to confirm compliance with this requirement.
- 4.7 Technical Manual: Technical manuals shall conform with the MIL-PRF-28800F standard. A Use and Installation manual (Operator's Manual) shall be provided separately. Maintenance and Servicing manual shall be provided with all three levels of maintenance; unit operational verification, module level, and component level. The technical manual shall be provided in both printed and electronic formats. The printed format shall be otherwise normally provided. The electronic format shall consist of the installation programs for the latest version of Adobe Acrobat for all computer platforms for which Acrobat is available and the technical manual in an electronic form that is readable through use of the Adobe Acrobat application.

- 4.8 Training Material Training material that demonstrates the features and basic operations of the portable radio test set shall be provided. The material can be either in CD-ROM with interactive feature or a video tape (VHS format).
- 4.9 Year 2000 Compliance: The manufacturer shall certify that the equipment is not susceptible to malfunction as a result of date/time functions associated with the calendar year 2000 or later.
- 4.10 Transit Case: A protective hard carrying case according to MIL-PRF-28800F shall be provided for transporting the test set. The transit case shall be capable to accommodate the equipment, accessories, and at least the Operator's Manual.
- 4.11 Identification Plate: As per requested by MIL-PRF-28800F the equipment identification plate shall be permanently affixed to two places the equipment and in front of the transit case. The identification plate shall contain the following information.

Manufacturer name and/or cage:

Part or model number:

Serial number:

National stock number:

Contract Number:

Military nomenclature or "Part of":